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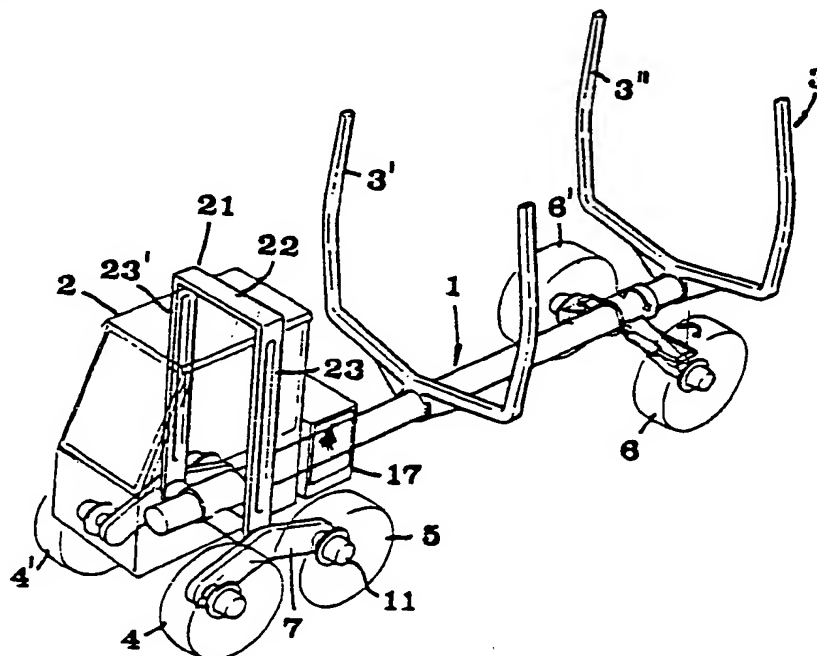
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(57) Abstract

A forwarder comprises a wheeled chassis (1), a driver's cab (2), and a load carrier (3) served by a crane. The forwarder comprises six hydrostatically, individually driven wheels (4, 4', 5, 5', 6, 6'), namely two single, steerable rear wheels (6, 6') located on each side of the chassis in the region underneath the load carrier (3), and four front wheels which are located in the region underneath the driver's cab (2) and of which a pair of wheels (4-5, 4'-5') located on the same side are mounted on a common yoke (7) so as to form a bogie which is individually pivotal relative to the chassis.

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FORWARDERTechnical field of the invention

This invention relates to a forwarder comprising a wheeled chassis, a driver's cab, a load carrier served by a crane, and six hydrostatically, individually driven wheels of which four front wheels located in the region underneath the cab are arranged in pairs in such a manner that a pair of wheels located on the same side are mounted on a common yoke so as to form a bogie which is individually pivotal relative to the chassis.

Summary of the invention

The present invention aims at providing a lightweight, compact forwarder which is easy and inexpensive to manufacture and which affords high reliability and convenience for the driver, and the crane of which can be readily and conveniently operated. According to the invention, this and other objects are achieved in that a bottom chassis part for the load carrier is rigidly connected to a front part of the chassis carrying the crane and/or the cab, and that two single rear wheels located underneath the load carrier on each side of the chassis are steerable by a pivotal movement relative to the chassis and mounted thereon by means of a pendulum suspension.

Brief description of the drawings

In the drawings, Fig. 1 is a simplified perspective view illustrating a first embodiment of the forwarder of the invention, Fig. 2 is a top plan view of the chassis of the same forwarder, Fig. 3 is a side view thereof, Fig. 4 is a front end view of the same forwarder, Fig. 5 is side view illustrating the forwarder in a particular state of operation, Fig. 6 is an end view illustrating the forwarder in another state of

operation, Fig. 7 is a side view of an alternative embodiment of the forwarder, Fig. 8 is top plan view of the chassis of the forwarder shown in Fig. 7, and Fig. 9 is a perspective view of yet another alternative embodiment of the invention.

Description of the preferred embodiments of the invention

The forwarder shown in Figs. 1-4 has a chassis generally designated 1 on which a driver's cab 2 is mounted, and a load carrier 3 which is disposed behind the cab and which in the illustrated embodiment is in the form of two loading bunks 3', 3". The chassis may advantageously consist of a sturdy, simple tubular structure mounted on six wheels, namely four front wheels 4, 4', 5, 5' and two rear wheels 6, 6'. The two front wheels 4, 5 located on the same side of the vehicle are mounted on a common yoke 7 so as to form a bogie which is individually pivotal relative to the chassis, more specifically relative to a transverse suspension arm 8 rigidly connected to the tubular structure 1. Similarly, the wheels 4', 5' are mounted on a yoke 7' which is pivotal relative to an arm 8'. The pivotal movement of each yoke about its pivot point 9 can be brought about by means of at least one hydraulic cylinder 10. In practice, there are mounted in each of the six wheels hydraulic motors 11 by means of which the wheels can be individually driven.

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The rear wheels 6, 6' are mounted on arms 12, 12' which are connected to the tubular structure forming the chassis, by means of a pendulum suspension 13 allowing the arms and, thus, the wheels to pivot or execute a pendulum movement relative to the chassis. The rear wheels are designed with so-called double-pivot steering, which means that they are pivotal relative

to vertical joints 14, 14' at the free ends of the arms 12, 12'. The pivotal movement of the wheels is ensured by a hydraulic cylinder 15 in combination with a track rod 16 ensuring that the wheels are always
5 turned in a uniform manner. According to a special feature of the invention, the two rear wheels 6, 6' may be idle, when so desired, in that the associated hydraulic motors are disengaged.

10 Behind the driver's cab 2, there is provided a drive unit 17 which may contain a fuel tank, an engine, a hydraulic motor, a hydraulic tank and hydraulic valves. Alternatively, this drive unit may be mounted for instance underneath the cab so as to
15 obtain an extremely compact forwarder. As best seen in Fig. 3, the operator can enter the cab 2 by the front, suitably in that a lower wall-forming part 18 can be folded down and is provided with steps on its inside, while an upper, transparent door 19 can
20 be swung upwards.

The crane 20 which is intended to serve the load carrier 3 is mounted with its base portion above the roof of the driver's cab 2. More specifically, the
25 crane is mounted on a frame 21 comprising a cross-beam 22 and two vertical legs 23, 23' on both sides of the cab. The legs 23, 23' are disposed approximately midway between the two front wheels 4, 5 of each bogie so as to provide sufficient stability in connection
30 with loading and unloading.

During cross-country driving, all six wheels are advantageously driven, so that the vehicle will run safely and with great power, although at a relatively low
35 speed (e.g. 0-10 km/h). When, on the other hand, the forwarder travels on a road at a high speed, the rear wheels are disconnected so as to become idle, and

the front wheel bogies are tilted in the manner illustrated in Fig. 5, whereby only two wheels, namely the wheels 5, 5' will rotate and be in driving engagement with the ground. In this manner, it is possible to increase the speed three times (e.g. up to 20-30 km/h). It is also conceivable to run the forwarder with all four front wheels in driving engagement with the ground, so as to obtain an intermediate speed (e.g. 10-20 km/h). The tilting of the front wheel bogies in the manner shown in Fig. 5 may also be effected during cross-country travel, for instance on a snowy ground, in which case the front wheels will compact the snow so as to facilitate the travel of the following wheels. Such tilting of the front wheel bogies may also be used for increasing the stability of the vehicle. Individual tilting of the wheel bogies may be effected when driving on sloping ground, as illustrated in Fig. 6. By such tilting, the cab can be maintained in a substantially horizontal position despite the slope of the ground.

Reference is now had to Figs. 7-8 showing an alternative embodiment in which the chassis, in addition to a cab-supporting part 24, has a tail part 25 connected to the part 24 by means of a joint 26. The tail part 25 is pivotal relative to the cab-supporting part 24 by means of at least one hydraulic cylinder 27 so as to provide articulated frame steering of the vehicle. In this case, too, the two rear wheels 6, 6' are mounted on the tail part by a pendulum suspension and are pivotal relative to the pendulum arms so as to provide double-pivot steering. This type of steering may advantageously be used when driving on a road, while articulated frame steering by means of the hydraulic cylinder 27 may be used during cross-country travel. In the illustrated embodiment, it is also possible to combine articulated frame steering

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with double-pivot steering. In the illustrated embodiment, the load carrier 3 has a sturdy bottom part 28 which projects from the cab-supporting part 24 and forms together therewith a single, rigid unit.

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Although a drive unit 17 is shown between the cab 2 and the load carrier 3, it is conceivable to build in the drive unit in the cab-supporting part 24 so as to reduce the overall length of the vehicle.

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In the embodiment shown in Fig. 9, the tubular structure 1' is rigidly connected to a front box or part 29 supporting the cab 2', the tube 1' and the front part 29 together forming a continuous rigid chassis. In this case, the crane or the frame 21' serving as attachment for the crane is stationarily connected to the cab 2' which is connected to the chassis, more precisely the front part 29 thereof, by the intermediary of a gear rim 30 or the like allowing the cab to rotate relative to the chassis. In this way, the crane will positively follow the cab during rotation thereof to different working positions. This in turn means that the operator sitting in the cab need not turn his body to follow the crane when moved to different working positions. In this context, it should also be noted that the central point about which both the cab and the crane pivot is always fixed in relation to the load carrier since the tubular structure 1' is rigidly connected to the front part 29.

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A unique feature of the inventive forwarder is that a single rigid chassis (in the form of a single tubular structure 1 according to Figs. 1-6; the front part 24 and the bottom part 28 rigidly connected thereto according to Figs. 7-8; and the front part 29 and the tubular structure 1' according to Fig. 9) carries

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both the load carrier 3 and the cab 2 as well as the crane 20 mounted on the cab. In this manner, the attachment or pivot point of the crane will always occupy one and the same geometrically fixed position in relation to the load carrier, this considerably facilitating loading and unloading of the load carrier as compared with such forwarders with articulated frame steering in which the load carrier is articulated in relation to the cab chassis and in which, as is well known, the load carrier may occupy highly different positions in relation to the crane. It should also be pointed out that the chassis of the forwarder does not require any special spring systems since the required spring action of the vehicle is fully satisfied by the resilience of the tyres of the wheels. Thus, the chassis can be manufactured in an extremely simple and inexpensive way.

Possible modifications of the invention

Naturally, the invention is not restricted only to the embodiments described above and shown in the drawings. Thus, the design of the driver's cab, the crane, the crane attachment, the load carrier and the chassis may be modified in several different ways within the spirit and scope of the accompanying claims.

CLAIMS

1. A forwarder comprising a wheeled chassis, a driver's cab, a load carrier served by a crane, and six hydrostatically, individually driven wheels (4, 4', 5, 5', 6, 6') of which four front wheels (4, 4', 5, 5') located in the region underneath the cab (2) are arranged in pairs in such a manner that a pair of wheels (4-5, 4'-5') located on the same side are mounted on a common yoke (7, 7') so as to form a bogie which is individually pivotal relative to the chassis (1), characterized in that a bottom chassis part (1, 28, 1') for the load carrier (3) is rigidly connected to a front part (8, 24, 29) of the chassis carrying the crane (20) and/or the cab (2), and that two single rear wheels (6, 6') located underneath the load carrier (3) on each side of the chassis are steerable by a pivotal movement relative to the chassis and mounted thereon by means of a pendulum suspension.

2. Forwarder as claimed in claim 1, characterized in that at least the two rear wheels (6, 6') may be idle, as desired, while simultaneously maintaining only two or alternatively all four front wheels (4, 4', 5, 5') in driving engagement with the ground.

3. Forwarder as claimed in any one of the preceding claims, characterized in that a frame (21) surrounding the cab for carrying the crane (20) is disposed with its legs (23, 23') approximately midway between the two front wheels of each bogie.

4. Forwarder as claimed in any one of the preceding claims, characterized in that each rear wheel (6, 6') is articulated to an arm (12, 12')

projecting from the pendulum suspension (13) and pivotal in relation to said arm by means of a hydraulic cylinder or the like (15) for steering said rear wheels at a desired angle relative to the front wheels.

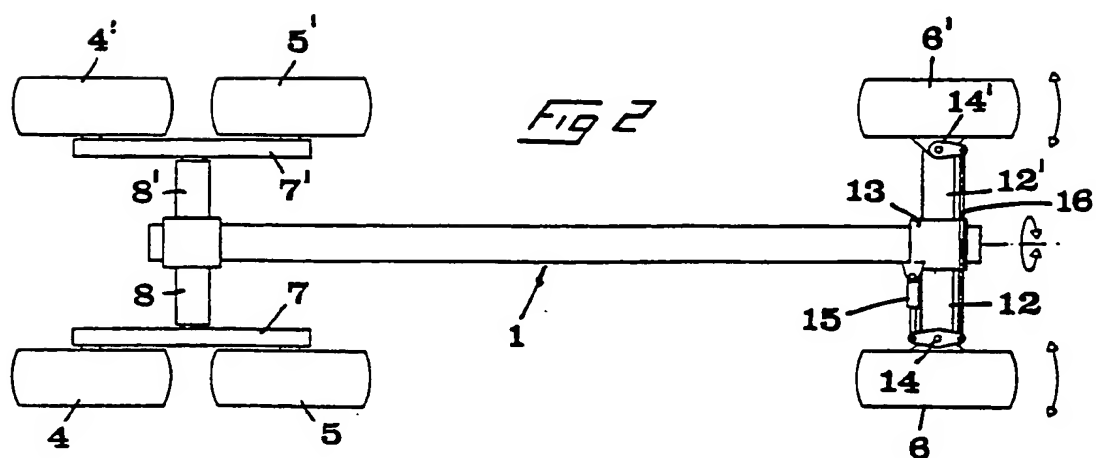
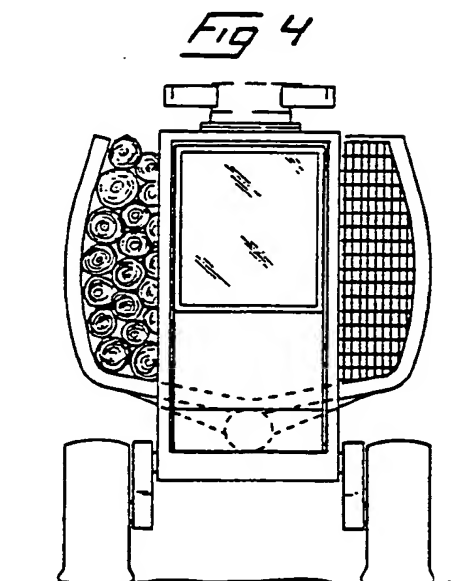
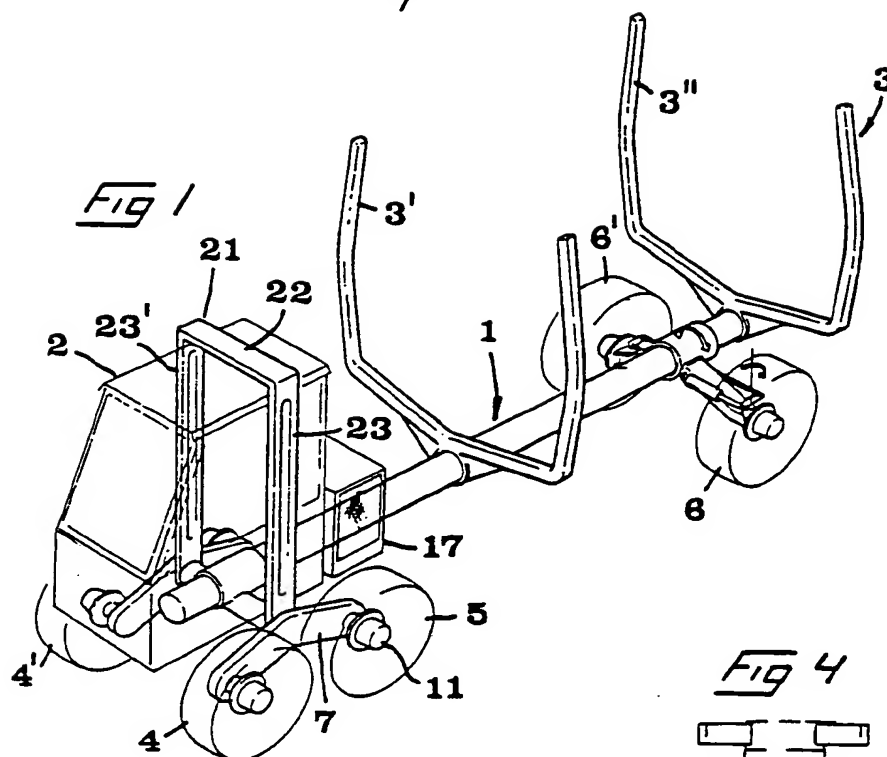
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5. Forwarder as claimed in any one of the preceding claims, characterized in that the chassis is in the form of a tubular or profiled structure (1) having bending and torsional rigidity and
10 extending between fixed suspension arms (8, 8') or a rigid frame or the like for the front wheel bogies and the pendulum-suspended arms (12, 12') for the rear wheels, both the load carrier (3) and the crane-supporting cab (2) being fixedly mounted on said structure.
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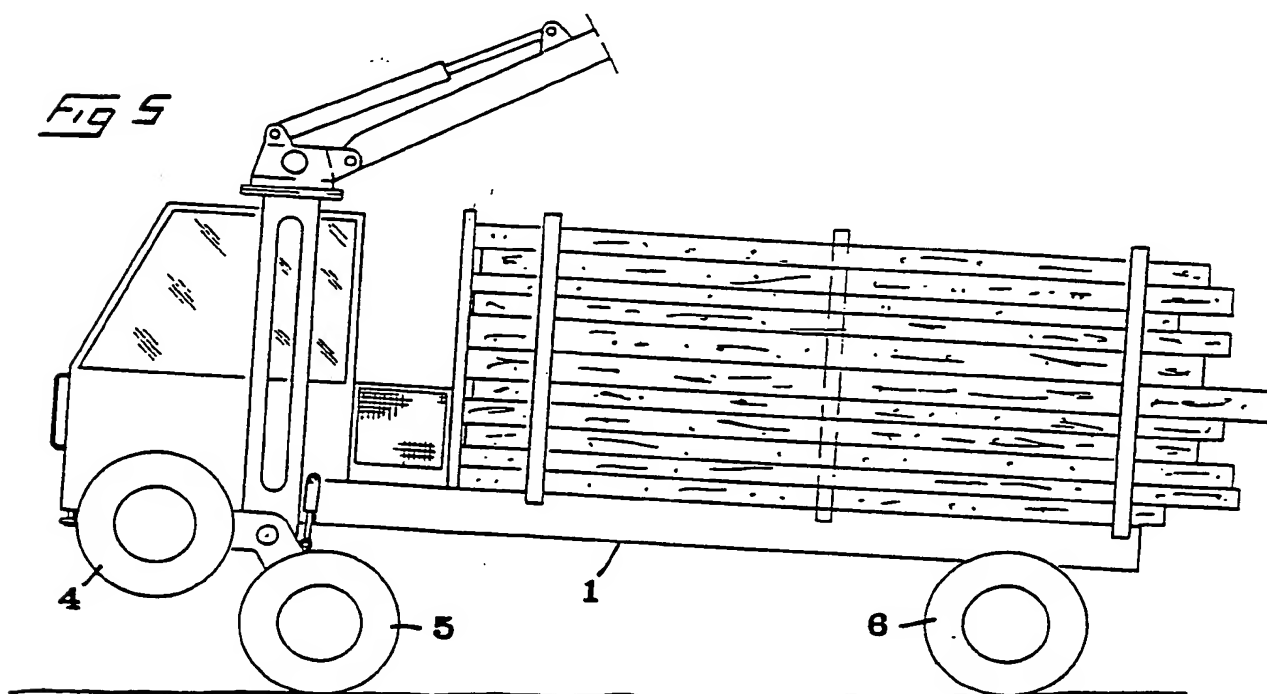
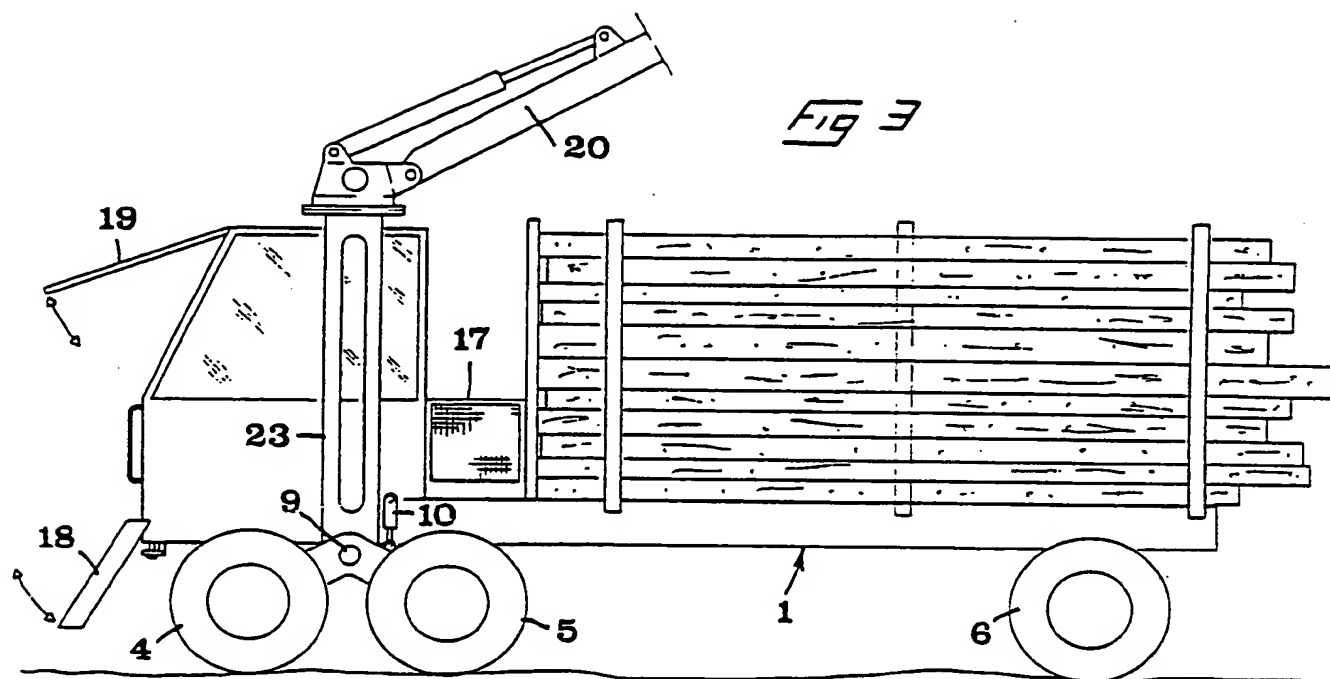
6. Forwarder as claimed in any one of claims 1-4, characterized in that the chassis, in addition to a cab-supporting part (24) on which the
20 bottom part (28) for the load carrier is rigidly mounted, comprises a tail part (25) articulated thereto and pivotal in relation to the cab-supporting part by means of at least one hydraulic cylinder or the like (27) for steering said rear wheels (6, 6') at
25 a desired angle relative to the front wheels.

7. Forwarder as claimed in any one of the preceding claims, characterized in that the crane or an attachment (21') therefor is rigidly connected to the cab (2') and that the cab (2') is rotatable relative to the chassis (29, 1').
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3/4

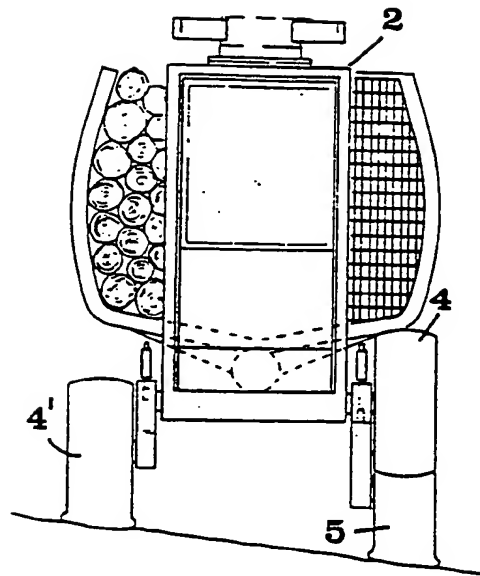


Fig 6

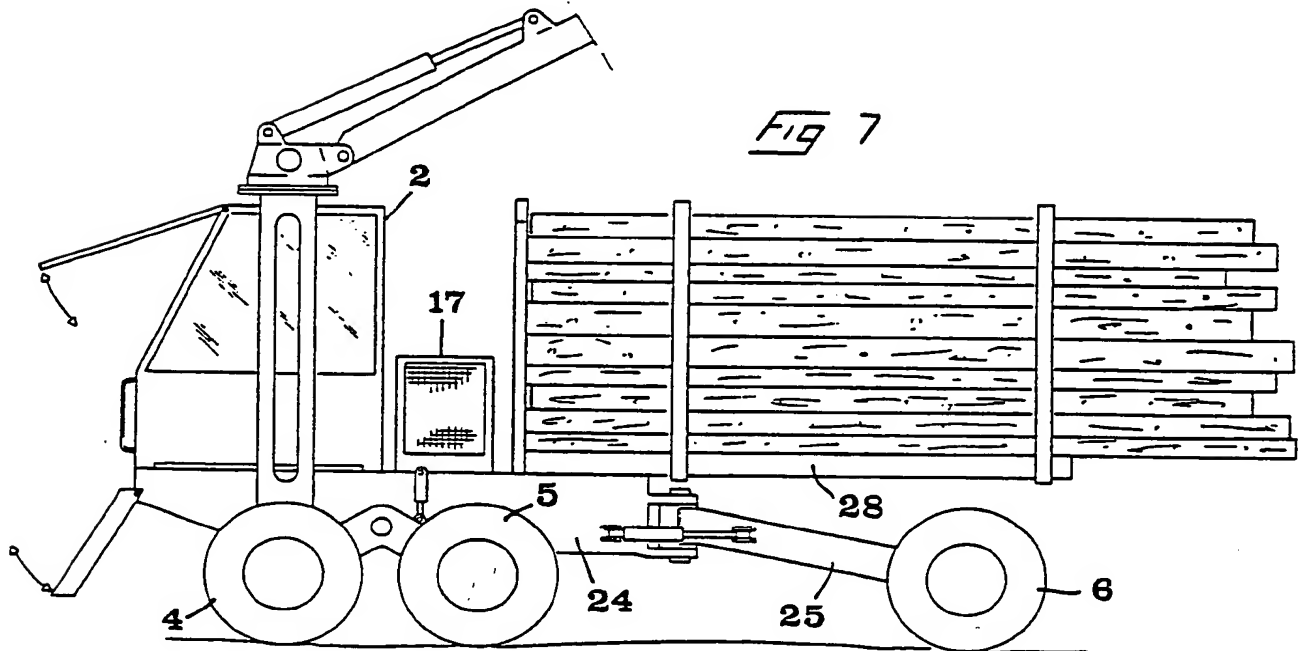


Fig 7

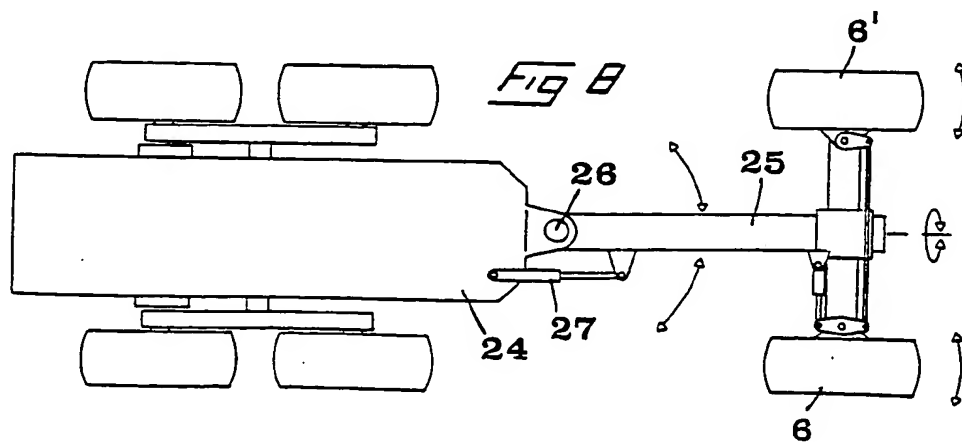
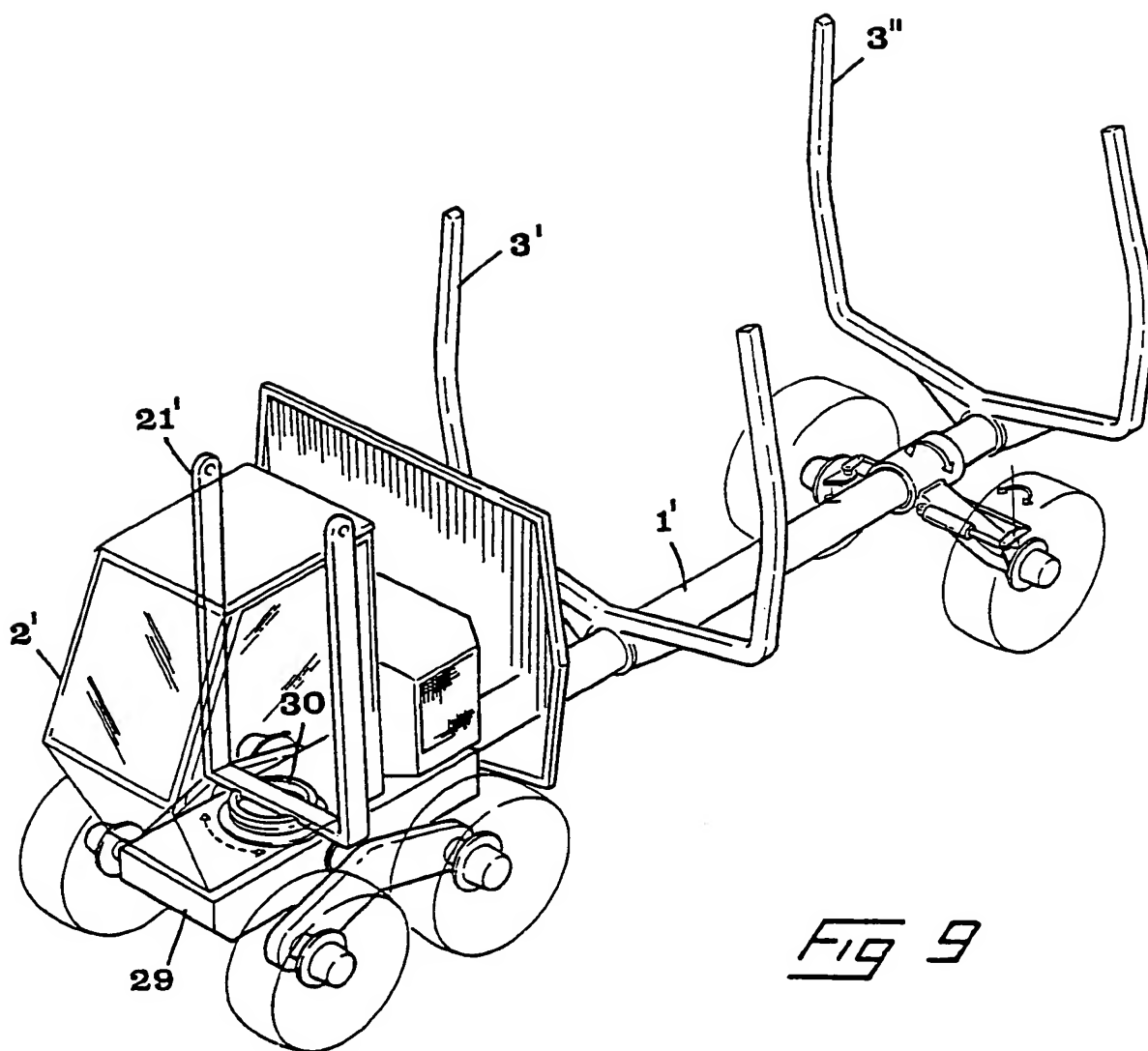


Fig 8

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INTERNATIONAL SEARCH REPORT

International Application No PCT/SE87/00003

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
B 62 D 61/10		4
II. FIELDS SEARCHED		
Minimum Documentation Searched ?		
Classification System	Classification Symbols	
IPC 4	B 62 D 11/00, 49/00-08, 53/00, /02, 61/00, /10, /12, 63/00, /02; B 60 P 3/40	
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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	SE, B, 400 243 (S-E DAHLIN, T NILSEN) 20 March 1978	1
A	US, A, 4 470 475 (K CARLSON) 11 September 1984	1
P	WO, A, 86/02893 (M CARLSON) 22 May 1986	1
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1987-03-20	1987-03-23	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	Kenneth Gustafsson	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields Searched (cont).

US C1 180:6.2, 6.48, 14, 21-24, 41;
280:111, 677, 682

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
☐ No protest accompanied the payment of additional search fees.